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## PATENT ABSTRACTS OF JAPAN

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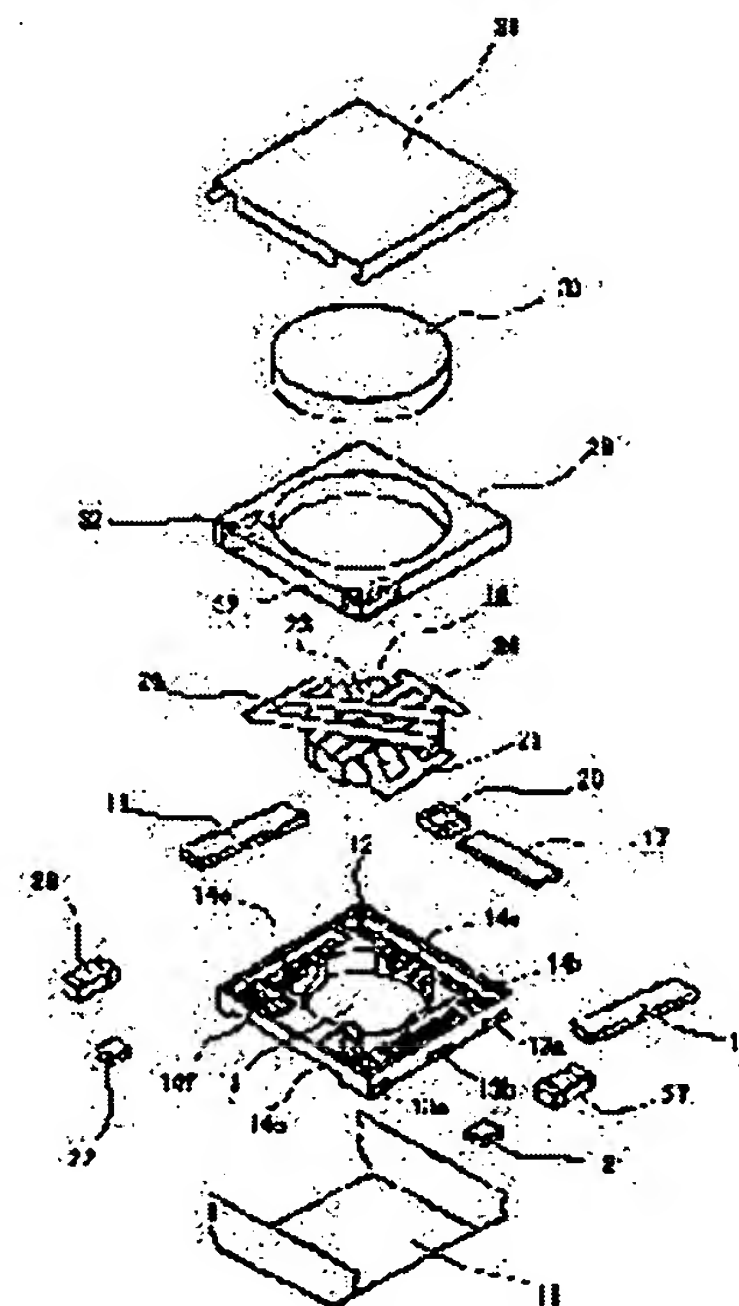
YAMANE KENICHI

## (54) CONCENTRATED CONSTANT NONREVERSIBLE CIRCUIT ELEMENT

## (57)Abstract:

PROBLEM TO BE SOLVED: To obtain the high attenuation of high frequency by connecting the serial LC circuit of inductors and capacitors to a center conductor on an input side and/or an output side so as to make wide in band.

SOLUTION: A recess part for inserting respective parts is formed at a resin case 12 arranged on a lower case 11, and external connecting terminals 13a, 13b,... are formed by three to three on opposed edges. The other ends of the respective terminals 13 are connected conductively with a connecting electrode in the case 12. A center conductor assembly 16, impedance matching capacitors 17 to 19 and a resistive element 20 are arranged in a recess part for inserting parts of the case 12. In addition, capacitors 21 and 22 for the serial LC circuit are arranged. These capacitors 21 and 22 for the serial LC circuit are flat capacitors and one electrode is conductively connected with their connecting electrodes 14c and 14f. Then, inductors 27 and 28 for the serial LC circuit are arranged between the upper electrode of the capacitors 21 and 22 for the serial LC circuit and center conductors 25 and 26.



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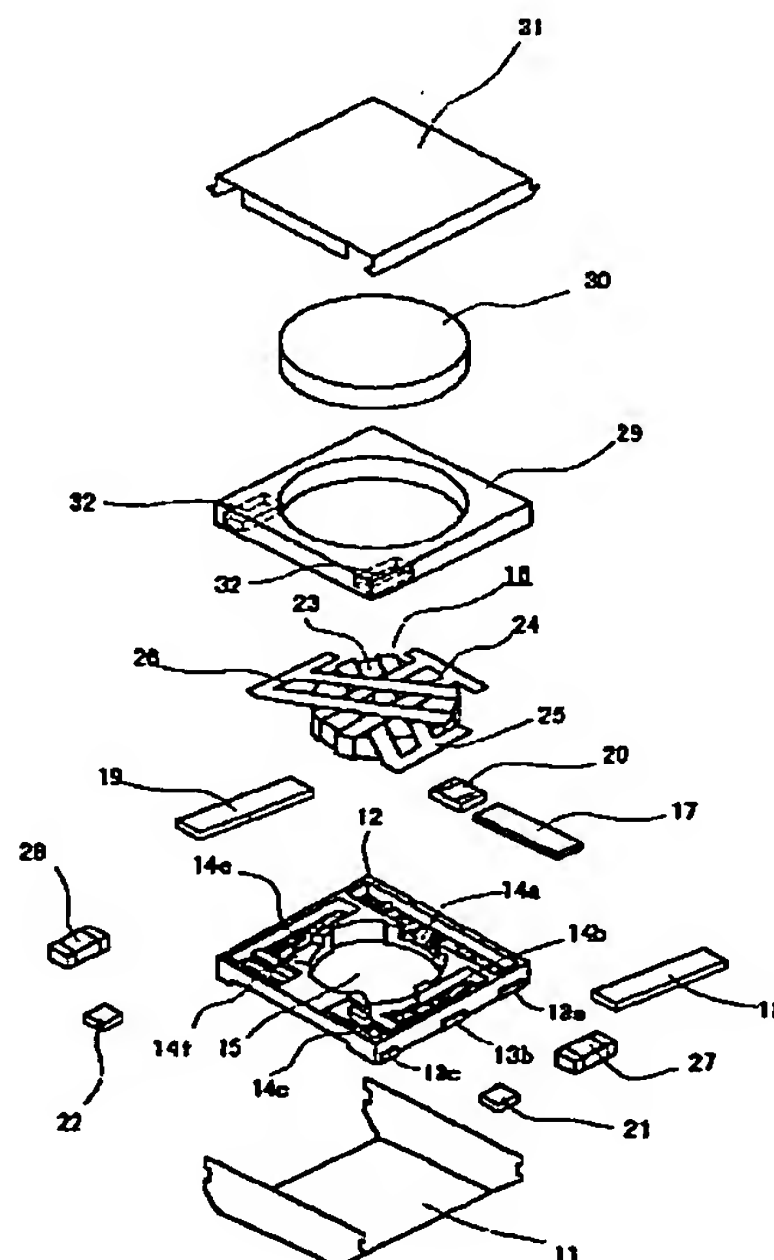
Fターム(参考) 5J013 EA01 FA03

(54) 【発明の名称】 集中定数型非可逆回路素子

(57) 【要約】

【課題】 広帯域化しかつ高調波成分を減衰させる機能を付加した集中定数型非可逆回路素子を提供する。

【解決手段】 樹脂ケースは整合用及び直列ＬＣ回路用の容量素子を位置決めする凹部を有し、該凹部の底部に、外部端子に導通した接続電極を配し、該接続電極上に前記整合用及び直列ＬＣ回路用の容量素子の一方の電極を接続し、中心導体の一端を前記整合用容量素子の他方の電極に接続し、前記入力用及び／又は出力用の中心導体と、前記直列ＬＣ回路用の容量素子の他方の電極との間に、Ｌ素子を接続することにより、入力及び／又は出力用の中心導体に直列ＬＣ回路を接続する。



## 【特許請求の範囲】

【請求項 1】 フェライトに電氣的絶縁状態で複数の中心導体を交差状に配置して構成された中心導体組立品と、前記各中心導体に接続される整合用容量素子と、前記中心導体組立品及び前記容量素子等を位置決めする凹部及び外部端子を有する樹脂ケースと、前記フェライトに直流磁界を印可する永久磁石を有し、これらを磁性ヨークを兼ねる金属ケース内に配置してなる集中定数型非可逆回路素子であり、前記中心導体のうち入力及び／又は出力用の中心導体と、該入力及び／又は出力端子との間に直列 LC 回路が接続されており、前記樹脂ケースは前記整合用及び直列 LC 回路用の容量素子を位置決めする凹部を有し、該凹部の底部には、外部端子に導通した接続電極を有し、該接続電極上に前記整合用及び直列 LC 回路用の容量素子の一方の電極を接続して、各容量素子が配置され、前記中心導体の一端は、前記整合用容量素子の他方の電極に接続され、前記入力用及び／又は出力用の中心導体と、前記直列 LC 回路用の容量素子の他方の電極との間に、L 素子が接続されていることを特徴とする集中定数型非可逆回路素子。

【請求項 2】 前記 L 素子を収納する凹部を有し、前記整合用容量素子を支持する凸部を有し、磁石を位置決めする貫通穴を有する樹脂モールドが前記樹脂ケース上に配置されていることを特徴とする請求項 1 記載の集中定数型非可逆回路素子。

【請求項 3】 前記中心導体組立品が配置される前記樹脂ケースの凹部は、貫通穴となっていることを特徴とする請求項 1 記載の集中定数型非可逆回路素子。

【請求項 4】 前記直列 LC 回路が接続されない中心導体のうち、少なくとも 1 つの中心導体の他端は抵抗に接続されて終端されていることを特徴とする請求項 1 記載の集中定数型非可逆回路素子。

【請求項 5】 前記 L 素子は、チップインダクタであることを特徴とする請求項 1 記載の集中定数型非可逆回路素子。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、携帯電話などのマイクロ波通信機器などに使用されるサーキュレータ、アイソレータなどの集中定数型非可逆回路素子に関し、特に、広帯域化を計りかつ 2 倍波、3 倍波の高調波を抑制することができる集中定数型非可逆回路素子に関するものである。

## 【0002】

【従来の技術】従来、サーキュレータ、アイソレータなどの集中定数型非可逆回路素子は、特定方向にのみ電力を伝送し、逆方向には伝送しない特性を有し、マイクロ波通信機器に使用されている。この集中定数型非可逆回路素子は、互いに絶縁状態で、120 度間隔で重ねられた 3 つの中心導体を磁性体上に配置し、その磁性体に直

流磁界を印加する永久磁石を有し、これらを磁性ヨークとなるケース内に収納して、構成されている。

【0003】従来の一例の集中定数型非可逆回路素子の分解斜視図を図 5 に示す。この従来例は、集中定数型アイソレータであり、上ケース 1 と下ケース 2 の間に、円板状フェライト 7 (ガーネット製) からなる磁性体上に 3 つの中心導体 8 を互いに絶縁状態で重ね、この中心導体組立品をセラミック基板 3 の透孔に配置し、セラミック基板 3 とともに下ケース 2 上に配置している。このとき、各中心導体 8 の一端は下ケースに接地される。また、各中心導体 8 の他端は、セラミック基板 3 上に形成された静電容量形成電極 4 に接続されている。一つの静電容量形成用電極 4 a は、ダミー抵抗 5 を介して接地電極 6 に接続され、終端されている。また、磁性体に直流磁界を印加する永久磁石 9 が上ケース 1 に配置され、この上ケース 1 と下ケース 2 を接合させて、集中定数型アイソレータが構成されている。

【0004】この上ケース 1 と下ケース 2 は、磁性体であり、磁性ヨークとして働き、永久磁石の磁力をフェライト 7 に印加する磁気回路を構成している。また、3 つの中心導体のうち、2 つの中心導体 8 の一端は延長されて突出し、入出力端子として用いられる。また、この中心導体組立品は、円形の板状体から突出する 3 つの中心導体からなり、その板状体上にフェライトを配置し、そのフェライトを包み込むように折り返されて、重ねられ、構成されている。尚、この中心導体間は絶縁されている。

【0005】この集中定数型非可逆回路素子は、携帯電話などのマイクロ波通信機器において使用される場合、高調波成分を抑制するローパスフィルタなどが入力端子側、又は出力端子側に接続されて使用される場合が多い。このローパスフィルタとしては、集中定数型非可逆回路素子が実装される基板上に、構成されることが多かった。

## 【0006】

【発明が解決しようとする課題】たとえば、携帯電話は、近年すさまじい勢いで普及し、その小型化も急速に進んでいる。そして、その携帯電話に使用される集中定数型非可逆回路素子も小型化が要求されている。また、小型化のみならず、低コストであることが要求されている。また、加入者数の増加による周波数帯の拡張に対応するため、広帯域をカバーする性能が要求されている。

【0007】従来の非可逆回路素子を広帯域化するための回路構成として、図 6 に示す等価回路が知られている。この従来例では、全ての入出力端に直列共振回路 51、52、53 を接続している。これにより、双峰特性が得られ、広帯域化することができる。尚、この従来例では、共振回路 53 の他端は終端抵抗 R で終端されている。

【0008】このように、従来の集中定数型非可逆回路



素子では、広帯域化するために、各入出力端、つまり全ての中心導体に対し、共振回路を接続しており、構成部品が多く、小型化、低コスト化に対し不利な構造であった。また、高調波成分を抑制するためにも、非可逆回路素子の実装基板上に、ローパスフィルタを接続する構造であり、小型化、低コスト化に対し不利な構造であった。

【0009】本発明は、集中定数型非可逆回路素子に広帯域化しかつ高調波成分を減衰させる機能を付加し、集中定数型非可逆回路素子の外部で接続されるローパス

【0010】

【課題を解決するための手段】本発明は、フェライトに電氣的絶縁状態で複数の中心導体を交差状に配置して構成された中心導体組立品と、前記各中心導体に接続される整合用容量素子と、前記中心導体組立品及び前記容量素子等を位置決めする凹部及び外部端子を有する樹脂ケースと、前記フェライトに直流磁界を印可する永久磁石を有し、これらを磁性ヨークを兼ねる金属ケース内に配置してなる集中定数型非可逆回路素子であり、前記中心導体のうち入力及び／又は出力用の中心導体と、該入力及び／又は出力端子との間に直列 LC 回路が接続されており、前記樹脂ケースは前記整合用及び直列 LC 回路用の容量素子を位置決めする凹部を有し、該凹部の底部には、外部端子に導通した接続電極を有し、該接続電極上に前記整合用及び直列 LC 回路用の容量素子の一方の電極を接続して、各容量素子が配置され、前記中心導体の一端は、前記整合用容量素子の他方の電極に接続され、前記入力用及び／又は出力用の中心導体と、前記直列 LC 回路用の容量素子の他方の電極との間に、L 素子が接続されている集中定数型非可逆回路素子である。

【0011】また本発明は、前記 L 素子を収納する凹部を有し、前記容量素子を支持する凸部を有し、磁石を位置決めする貫通穴を有する樹脂モールドが前記樹脂ケース上に配置されている集中定数型非可逆回路素子である。

【0012】また本発明は、前記中心導体組立品が配置される前記樹脂ケースの凹部は、貫通穴となっている集中定数型非可逆回路素子である。

【0013】また本発明は、前記直列 LC 回路が接続されない中心導体のうち、少なくとも 1 つの中心導体の他端は抵抗に接続されて終端されている集中定数型非可逆回路素子である。

【0014】また本発明は、前記 L 素子は、チップインダクタである集中定数型非可逆回路素子である。

【0015】

【発明の実施の形態】本発明では、集中定数型非可逆回路素子のみでなく、その入力側又は出力側に接続されるローパスフィルタを合わせて小型化することを検討した。また、簡易な回路で広帯域化できないかを検討した。そして、磁性ヨークに収納され、ワンパッケージ化された集中定数型非可逆回路素子内において、入力側のみ、又は出力側のみ、又は入力側及び出力側のみを中心導体の端部に直列に LC 回路を接続することにより、広帯域化と高調波の高減衰を得ることを可能としたものである。

【0016】本発明において、中心導体に接続される直列 LC 回路は、従来のように、全ての中心導体に共振回路を接続する構造とは異なり、選択的に直列 LC 回路を接続するのみであり、部品点数を削減できる。しかも、本発明では、高調波の高減衰を得ることができ、従来のようなローパスフィルタの接続を不要とするものである。

【0017】つまり、本発明では、直列 LC 回路が広帯域化を計り、しかも高調波の高減衰を得る作用を有している。

【0018】本発明の直列 LC 回路のインダクタは、例えば、フレキシブル基板上あるいはプリント基板上に銅箔のパターンでコイルを形成し、用いることができるが、チップインダクタであることが好ましい。

【0019】本発明の直列 LC 回路のコンデンサは、チップコンデンサでも良いが、例えば誘電体の薄板の両面に電極を設けた単板コンデンサを用いることが好ましい。

【0020】この直列 LC 回路は、アイソレータの入力側と出力側の両方に接続することが望ましいが、入力側または出力側のみに接続しても良い。

【0021】本発明は、樹脂ケースに整合用及び直列 LC 回路用の容量素子を位置決めする凹部及び外部端子を設け、該凹部の底部に、外部端子に導通した接続電極を設け、該接続電極上に前記容量素子の一方の電極を接続して、各容量素子が配置されている。そして、中心導体の一端が、前記接続電極上に配置された整合用容量素子の他方の電極に接続され、入力用端子及び／又は出力用端子に接続される中心導体と、前記接続電極上に配置された直列 LC 回路用容量素子の他方の電極との間に、直列 LC 回路用の L 素子が接続されている。これにより、各素子を効率よく配置でき、小型、薄型に集中定数型非可逆回路素子を構成している。

【0022】また本発明の樹脂ケースは、中心導体組立体を位置決めする凹部を有し、容量素子等との接続性を良くし、またその凹部を貫通状とすることにより、薄型化を計ることができる。

【0023】また本発明では、樹脂ケース上に配置された容量素子、L 素子等の位置精度を向上させ、また位置ずれ等を防止するために支持するために、L 素子を収納

する凹部を有し、前記容量素子を支持する凸部を有し、磁石を位置決めする貫通穴を有する樹脂モールドを樹脂ケース上に配置している。

#### 【0024】

【実施例】本発明に係る第1実施例の分解斜視図を図1に示す。また、この実施例の等価回路図を図2に示す。この実施例は、集中定数型アイソレータである。また、この実施例の樹脂ケースの平面図を図3に示す。図1、3で斜線部は電極（接続電極）を示している。この実施例は、下ケース11上に樹脂ケース12が配置される。この樹脂ケース12は、各部品挿入用の凹部が形成され、外部接続端子13a、13b、13c、13d、13e、13fが対向する辺に3つずつ形成されている。その各外部接続端子13の他端は、樹脂ケース12の内部で、接続電極と導通している。外部端子13aと13dは接続電極14aと導通し、外部端子13bは接続電極14bと、外部端子13cは接続電極14cと、外部端子13eは接続電極14eと、外部端子13fは接続電極14fと、それぞれ接続している。その樹脂ケース12の部品挿入用の凹部に中心導体組立品16、整合用コンデンサ17、18、19、抵抗素子20が配置される。また、直列LC回路用のコンデンサ21、22が配置される。

【0025】この中心導体組立品16は、フェライト23を包み込むように、3つの中心導体24、25、26が折り込まれている。この中心導体は、フェライト23の一面上で、各中心導体間に絶縁シートを挟んで互いに絶縁され、所定角度で交差している。この中心導体組立品16は、樹脂ケース12の中央の穴部15に配置され、この穴部15は貫通しており、下ケース11とフェ

ライト23の下部が接合し、各中心導体は、一端で接地される構造となっている。

【0026】この実施例の樹脂ケース12部分を更に詳細に説明する。樹脂ケース12の接続電極14a、14b、14e上に整合用のコンデンサ17、18、19が配置される。この整合用のコンデンサ17、18、19\*

	挿入損失 (dB)	2倍波減衰量 (dB)	3倍波減衰量 (dB)	VSWR
実施例	0.7	3.8	4.1	1.3
比較例	0.6	2.3	2.3	1.5

【0031】表1に示すように、本発明の実施例では、挿入損失はやや増加するもののVSWRを広帯域化し、かつ、中心周波数( $f_0$ )の2倍波の減衰量および3倍波の減衰量を大幅に向上させることが出来ている。この表1の比較例は、実施例のインダクタ27、28、コンデンサ21、22を接続しない構造の場合である。

【0032】上記実施例では、直列LC回路用のインダクタとしてチップインダクタを用いたが、他の構成のインダクタであってもよい。また、直列LC回路用のイン

\*は、平板コンデンサであり、一方の電極がその接続電極と導通される。また、樹脂ケース12の接続電極14a上には抵抗素子20が配置される。この抵抗素子20は、一方の電極が下部まで延長され、接続電極と導通される。そして、各整合用コンデンサ17、18、19上に各中心導体24、25、26が配置され、各整合用コンデンサ17、18、19の他方の電極と各中心導体が導通される。また、中心導体24は、抵抗素子20の他方の電極とも導通される。

【0027】また樹脂ケース12の接続電極14c、14f上に直列LC回路用コンデンサ21、22が配置される。この直列LC回路用コンデンサ21、22も平板コンデンサであり、一方の電極がその接続電極14c、14fと導通される。そして、その直列LC回路用のコンデンサ21、22の上方の電極と中心導体25、26との間に直列LC回路用のインダクタ27、28が配置され、接続される。この様子を図4に示す。

【0028】そして、樹脂モールド29で永久磁石30を位置決めし、上ケース31を被せて、集中定数型アイソレータを構成した。尚、この樹脂モールド29は、インダクタ27、28を収納するような凹部32が形成されており、また、中心導体及び整合用コンデンサを支持する凸部も有しており、これらの位置ずれ等を抑制する働きを有している。この実施例では、従来の構造に対し、入力側および出力側にインダクタ27、28、およびコンデンサ21、22を直列に接続した構造であり、従来と同サイズで集中定数型アイソレータを構成することができた。

【0029】この実施例では、3.9mmφのガーネット、5.5mmφの永久磁石を用い、7mm角、高さ2mmの小型、薄型集中定数型アイソレータであり、889~960MHz( $f_0$ :924.5MHz)帯用のアイソレータを構成し、表1に示す特性を得た。

#### 【0030】

#### 【表1】

ダクタとコンデンサとして、一体に積層した積層LCチップ部品を用いても良い。

【0033】上記実施例では、入力端及び出力端にインダクタとコンデンサの直列LC回路を接続したが、入力端側あるいは出力端側のいずれか一方のみに接続しても良い。また、上記実施例では、アイソレータで説明したが、サーキュレータであっても同様である。

【0034】本発明の実施例によれば、単に入力側のみ、または出力側のみ、または入力側及び出力側のみに

インダクタとコンデンサを直列に接続することにより、広帯域化を計るとともに、2倍波、3倍波といった高調波を抑制することが出来、従来別部品として付加されていたローパスフィルタといった部品を排除出来、集中定数型非可逆回路素子の高機能化と、マイクロ波装置の小型化を達成することができる。

#### 【0035】

【発明の効果】本発明によれば、集中定数型非可逆回路素子において、入力側および／または出力側の中心導体にインダクタとコンデンサの直列LC回路を接続することにより、広帯域化を計るとともに高調波の高減衰を得ることができる集中定数型非可逆回路素子を得ることができる。また樹脂ケースを用い、面実装であり、しかもコンパクトにまとまった集中定数型非可逆回路素子であって、高調波の高減衰を得ることができる。また、従来複数の部品が必要だったものを1つの部品で達成することができる。また集中定数型非可逆回路素子としても従来と同サイズで、しかも簡単な構造で達成されるものであり、機器の小型化、低コスト化に極めて有益である。

#### 【図面の簡単な説明】

【図1】本発明に係る第1実施例の分解斜視図である。

【図2】本発明に係る第1実施例の等価回路図である。

【図3】本発明に係る第1実施例の樹脂ケースの平面図

である。

【図4】本発明に係る第1実施例の中心導体と直列LC回路の接続部の説明図である。

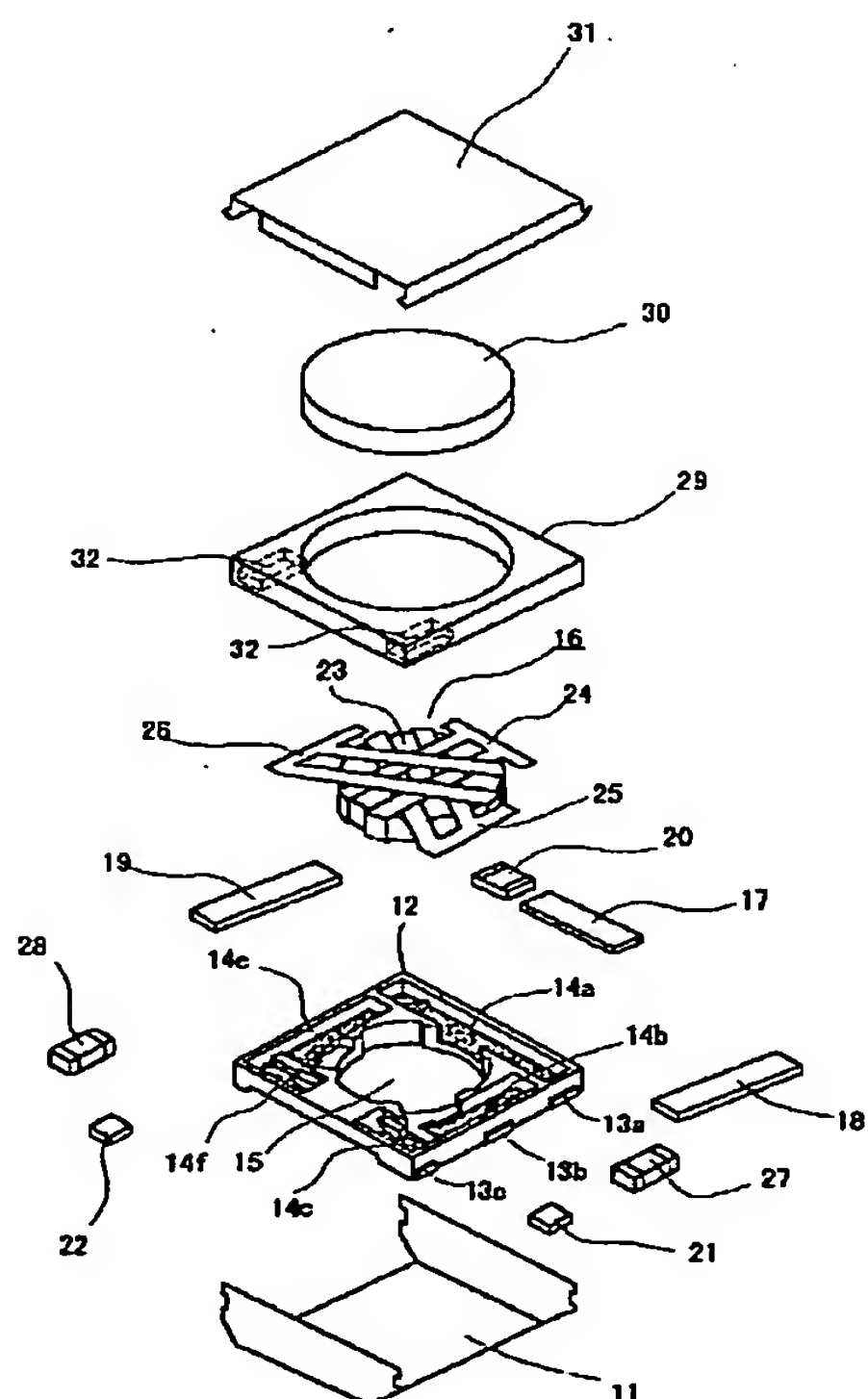
【図5】従来例の分解斜視図である。

【図6】従来の一例の等価回路図である。

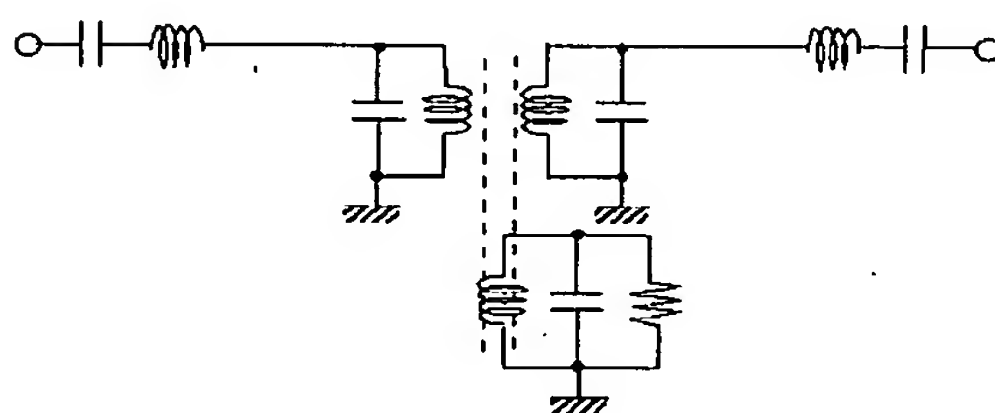
#### 【符号の説明】

- 11 下ケース
- 12 樹脂ケース
- 13a、13b、13c、13d、13e、13f 外部端子
- 14a、14b、14c、14e、14f 接続電極
- 15 貫通穴
- 16 中心導体組立品
- 17、18、19 整合用コンデンサ
- 20 抵抗素子
- 21、22 直列LC回路用コンデンサ
- 23 フェライト
- 24、25、26 中心導体
- 27、28 直列LC回路用インダクタ
- 29 樹脂モールド
- 30 磁石
- 31 上ケース

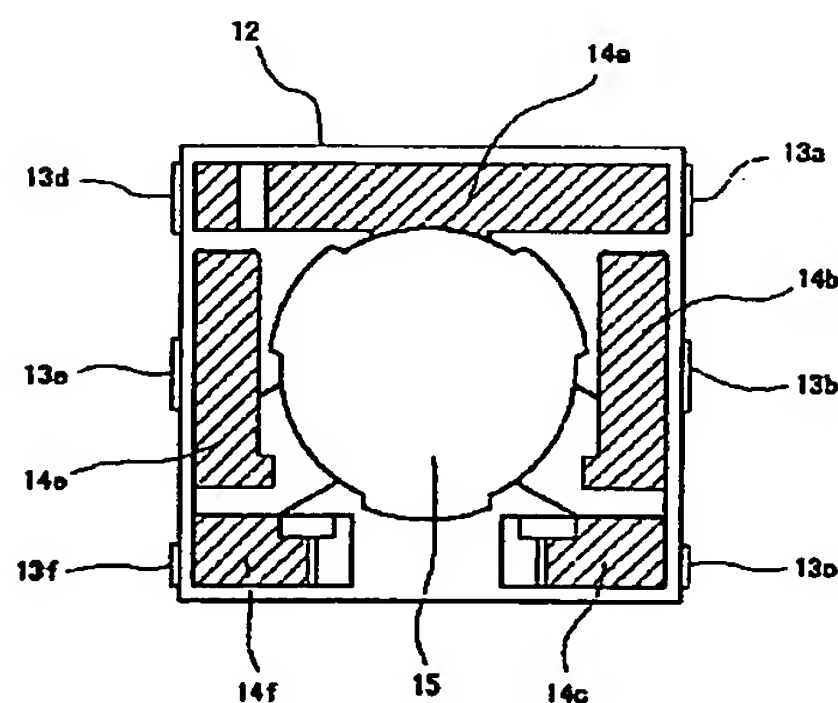
【図1】



【図2】

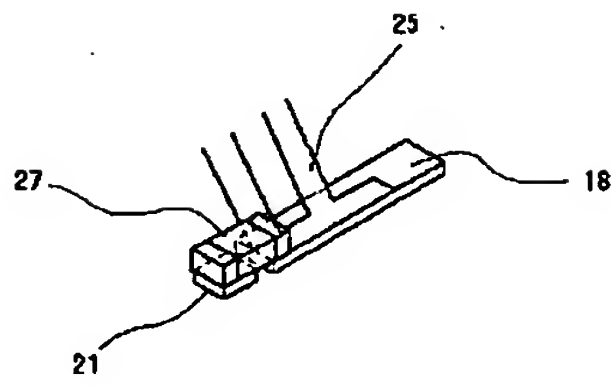


【図3】

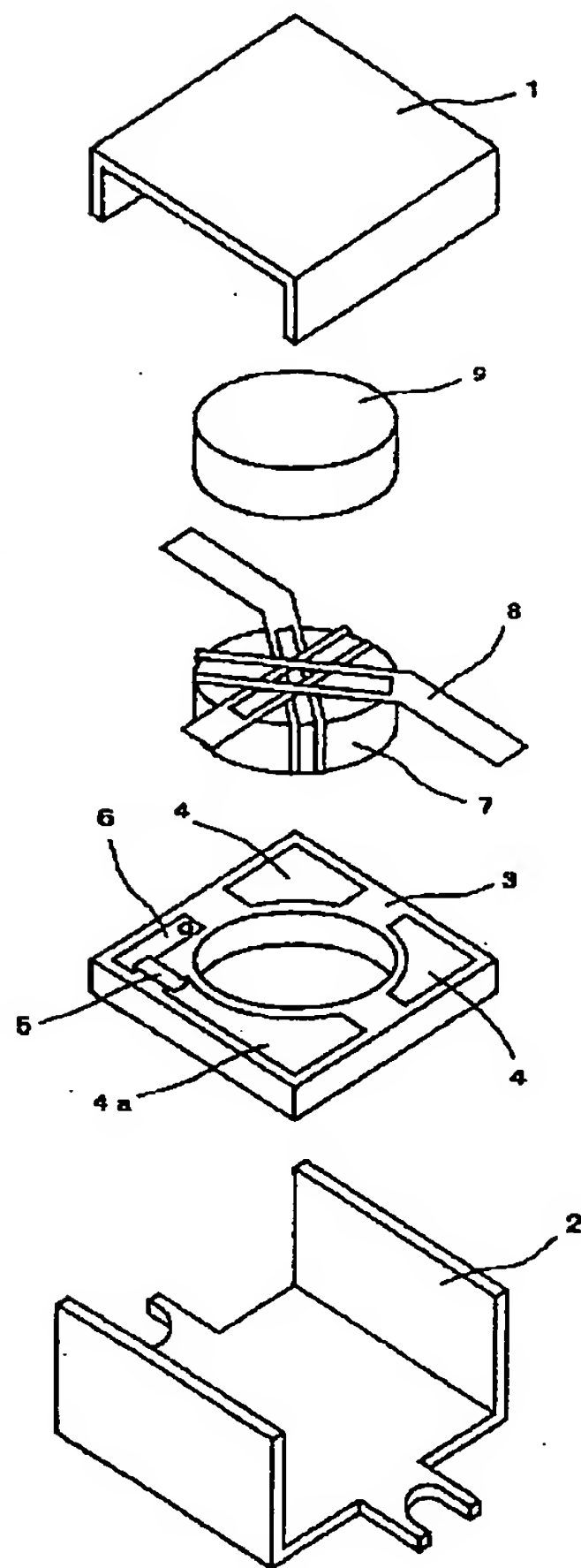




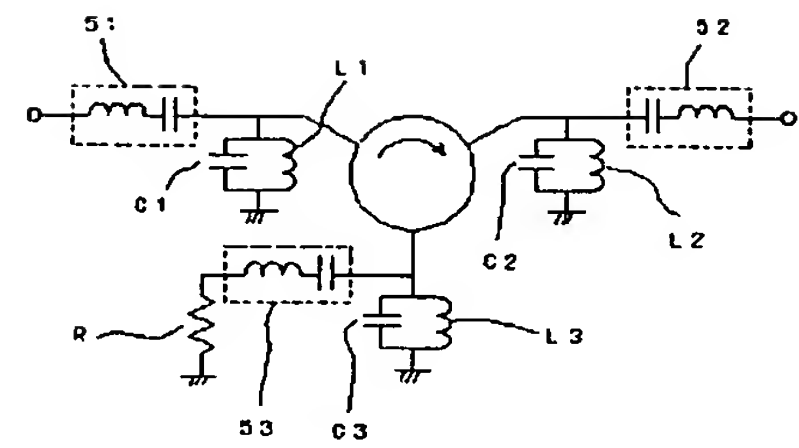
【図4】



【図5】



【図6】



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CLAIMS

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## [Claim(s)]

[Claim 1] The central conductor assembly constituted from an electric insulation condition by the ferrite by arranging two or more central conductors in the shape of a crossover, The resin case where it has the crevice and external terminal which position the capacitative element for adjustment connected to said each central conductor, said central conductor assembly, said capacitative element, etc., It is the concentrated-constant mold non-reciprocal circuit component which has the permanent magnet which carries out the seal of approval of the direct-current field to said ferrite, and comes to arrange these in the metal casing which serves as magnetic York. Among said central conductors The central conductor for an input and/or an output, The serial LC circuit is connected between this input and/or the output terminal, and said resin case has the crevice which positions the capacitative element said object for adjustment, and for serial LC circuits. At the pars basilaris ossis occipitalis of this crevice It has the connection electrode which flowed for the external terminal, one electrode of the capacitative element said object for adjustment and for serial LC circuits is connected on this connection electrode, and each capacitative element is arranged. The end of said central conductor The concentrated-constant mold non-reciprocal circuit component characterized by connecting with the electrode of another side of said capacitative element for adjustment, and connecting L elements between said object for an input and/or the central conductor for an output, and the electrode of another side of the capacitative element for said serial LC circuits.

[Claim 2] The concentrated-constant mold non-reciprocal circuit component according to claim 1 characterized by arranging the resin mold which has the crevice which contains said L elements, has the heights which support said capacitative element for adjustment, and has the through hole which positions a magnet on said resin case.

[Claim 3] The crevice of said resin case where said central conductor assembly is arranged is a concentrated-constant mold non-reciprocal circuit component according to claim 1 characterized by being a through hole.

[Claim 4] It is the concentrated-constant mold non-reciprocal circuit component according to claim 1 characterized by connecting and carrying out termination of the other end of at least one central conductor to resistance among the central conductors to which said serial LC circuit is not connected.

[Claim 5] Said L elements are a concentrated-constant mold non-reciprocal circuit component according to claim 1 characterized by being a chip inductor.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the concentrated-constant mold non-reciprocal circuit component which can control the higher harmonic of a wave 2 double wave and 3 times by measuring broadband-ization especially about concentrated-constant mold non-reciprocal circuit components used for microwave communication equipment, such as a cellular phone, etc., such as a circulator and an isolator.

[0002]

[Description of the Prior Art] Conventionally, concentrated-constant mold non-reciprocal circuit components, such as a circulator and an isolator, have the property which transmits power only in the specific direction and is not transmitted to hard flow, and are used for microwave communication equipment. It is in an insulating condition mutually, and this concentrated-constant mold non-reciprocal circuit component arranges three central conductors piled up at intervals of 120 degrees on the magnetic substance, has the permanent magnet which impresses a direct-current field to that magnetic substance, it contains these in the case used as magnetic York, and is constituted.

[0003] The decomposition perspective view of the concentrated-constant mold non-reciprocal circuit component of a conventional example is shown in drawing 5. This conventional example is a concentrated-constant mold isolator, it piled up three central conductors 8 of each other in the state of the insulation on the magnetic substance which consists of a disc-like ferrite 7 (product made from a garnet) between the upper case 1 and the bottom case 2, has arranged this central conductor assembly to the bore of a ceramic substrate 3, and arranges it on the bottom case 2 with the ceramic substrate 3. The end of each central conductor 8 is grounded by the bottom case at this time. Moreover, the other end of each central conductor 8 is connected to the electrostatic-capacity formation electrode 4 formed on the ceramic substrate 3. Termination of the electrode 4a for one electrostatic-capacity formation is connected and carried out to the earth electrode 6 through the dummy resistor 5. Moreover, the permanent magnet 9 which impresses a direct-current field to the magnetic substance is arranged at the upper case 1, this upper case 1 and the bottom case 2 are joined, and the concentrated-constant mold isolator is constituted.

[0004] Besides, a case 1 and the bottom case 2 are the magnetic substance, work as magnetic York and constitute the magnetic circuit which impresses the magnetism of a permanent magnet to a ferrite 7. Moreover, among three central conductors, the end of two central conductors 8 is extended and is used as a projection and an input/output terminal. Moreover, this central conductor assembly consists of three central conductors which project from a circular plate, arranges a ferrite on that plate, and it is turned up, and it piles up and it is constituted so that that ferrite may be wrapped in. In addition, it insulates between this central conductor.

[0005] This concentrated-constant mold non-reciprocal circuit component is used for an input terminal or output terminal side for the low pass filter which controls harmonic content in many cases, connecting, when used in microwave communication equipment, such as a cellular phone. As this low pass filter, it was constituted in many cases on the substrate with which a concentrated-constant mold non-reciprocal circuit component is mounted.

[0006]

[Problem(s) to be Solved by the Invention] For example, a cellular phone spreads with vigor frightful in recent years, and the miniaturization is also progressing quickly. And the miniaturization is demanded also for the concentrated-constant mold non-reciprocal circuit component used for the cellular phone. Moreover, not only a miniaturization but to be low cost is demanded. Moreover, since it corresponds to the escape of the frequency band by the increment in the

number of subscribers, the engine performance which covers a broadband is demanded.

[0007] The equal circuit which shows the conventional non-reciprocal circuit component to drawing 6 as circuitry for broadband-izing is known. In this conventional example, series resonant circuits 51, 52, and 53 are connected to all I/O edges. Thereby, a double hump response is acquired and can broadband-ize. In addition, in this conventional example, termination of the other end of a resonance circuit 53 is carried out by Terminator R.

[0008] Thus, with the conventional concentrated-constant mold non-reciprocal circuit component, in order to broadband-ize, the resonance circuit was connected to each I/O edge, i.e., all central conductors, and there were many component parts and they were disadvantageous structure to a miniaturization and low-cost-izing. Moreover, also in order to control harmonic content, it was the structure of connecting a low pass filter on the mounting substrate of a non-reciprocal circuit component, and was disadvantageous structure to a miniaturization and low-cost-izing.

[0009] This invention adds the function to broadband-ize for a concentrated-constant mold non-reciprocal circuit component, and to attenuate harmonic content. The low pass filter connected in the exterior of a concentrated-constant mold non-reciprocal circuit component is lost, and it aims at offering the concentrated-constant mold non-reciprocal circuit component which can attain the whole miniaturization. With moreover very simple structure It aims at offering the concentrated-constant mold non-reciprocal circuit component which can obtain high attenuation of a higher harmonic at the same time it achieves broadband-ization.

[0010]

[Means for Solving the Problem] The central conductor assembly constituted by this invention arranging two or more central conductors in the electric insulation condition in the shape of a crossover to a ferrite, The resin case where it has the crevice and external terminal which position the capacitive element for adjustment connected to said each central conductor, said central conductor assembly, said capacitive element, etc., It is the concentrated-constant mold non-reciprocal circuit component which has the permanent magnet which carries out the seal of approval of the direct-current field to said ferrite, and comes to arrange these in the metal casing which serves as magnetic York. Among said central conductors The central conductor for an input and/or an output, The serial LC circuit is connected between this input and/or the output terminal, and said resin case has the crevice which positions the capacitive element said object for adjustment, and for serial LC circuits. At the pars basilaris ossis occipitalis of this crevice It has the connection electrode which flowed for the external terminal, one electrode of the capacitive element said object for adjustment and for serial LC circuits is connected on this connection electrode, and each capacitive element is arranged. The end of said central conductor It is the concentrated-constant mold non-reciprocal circuit component by which connects with the electrode of another side of said capacitive element for adjustment, and L elements are connected between said object for an input and/or the central conductor for an output, and the electrode of another side of the capacitive element for said serial LC circuits.

[0011] Moreover, this invention is a concentrated-constant mold non-reciprocal circuit component by which the resin mold which has the crevice which contains said L elements, has the heights which support said capacitive element, and has the through hole which positions a magnet is arranged on said resin case.

[0012] Moreover, the crevice of said resin case where, as for this invention, said central conductor assembly is arranged is a concentrated-constant mold non-reciprocal circuit component used as a through hole.

[0013] Moreover, the other end of at least one central conductor is a concentrated-constant mold non-reciprocal circuit component by which termination is connected and carried out to resistance among the central conductors to which, as for this invention, said serial LC circuit is not connected.

[0014] Moreover, this invention is a concentrated-constant mold non-reciprocal circuit component said whose L elements are chip inductors.

[0015]

[Embodiment of the Invention] This invention considered setting the low pass filter connected not only to a concentrated-constant mold non-reciprocal circuit component but to the input side or output side, and miniaturizing. Moreover, it examined whether-izing could be carried out [ broadband ] in a simple circuit. And it is contained by magnetic York and only an input side makes [ an output side ] it possible to obtain high attenuation of broadband-izing and a higher harmonic by connecting LC circuit to the edge of the central conductor of only an input side and an output side at a serial into the concentrated-constant mold non-reciprocal circuit component formed into the one package.

[0016] Like before, unlike the structure of connecting a resonance circuit to all central conductors, it is only connecting a serial LC circuit alternatively, and the serial LC circuit connected to a central conductor can reduce components mark



in this invention. And in this invention, high attenuation of a higher harmonic can be obtained and connection of a low pass filter like before is made unnecessary.

[0017] That is, in this invention, a serial LC circuit measures broadband-ization and has the operation which moreover obtains high attenuation of a higher harmonic.

[0018] Although a coil can be formed and used for the inductor of the serial LC circuit of this invention by the pattern of copper foil for example, on a flexible substrate or a printed circuit board, it is desirable that it is a chip inductor.

[0019] Although a chip capacitor is sufficient as the capacitor of the serial LC circuit of this invention, it is desirable to use the veneer capacitor which prepared the electrode, for example in both sides of the sheet metal of a dielectric.

[0020] Although it is desirable to connect with both the input side of an isolator and an output side as for this serial LC circuit, it may be connected only to an input side or an output side.

[0021] This invention prepares the crevice and external terminal which position the capacitive element for the object for adjustment, and serial LC circuits in a resin case, prepares the connection electrode which flowed for the external terminal at the pars basilaris ossis occipitalis of this crevice, connects one electrode of said capacitive element on this connection electrode, and each capacitive element is arranged. And L for serial LC circuits are connected between the central conductor which the end of a central conductor is connected to the electrode of another side of the capacitive element for adjustment arranged on said connection electrode, and is connected to the terminal for an input, and/or the terminal for an output, and the electrode of another side of the capacitive element for serial LC circuits arranged on said connection electrode. Thereby, each component can be arranged efficiently and the concentrated-constant mold non-reciprocal circuit component is constituted in small and a thin shape.

[0022] Moreover, the resin case of this invention can measure thin shape-ization by having the crevice which positions a central conductor assembly, and improving connectability with a capacitive element etc., and making the crevice into the letter of penetration.

[0023] Moreover, in order to raise location precision arranged on a resin case, such as a capacitive element and L etc. elements, in this invention, and to prevent a location gap etc. and to support, the resin mold which has the crevice which contains L elements, has the heights which support said capacitive element, and has the through hole which positions a magnet is arranged on a resin case.

[0024]

[Example] The decomposition perspective view of the 1st example concerning this invention is shown in drawing 1 . Moreover, the representative circuit schematic of this example is shown in drawing 2 . This example is a concentrated-constant mold isolator. Moreover, the top view of the resin case of this example is shown in drawing 3 . The slash section shows the electrode (connection electrode) by drawing 1 and 3. As for this example, the resin case 12 is arranged on the bottom case 11. The crevice for each part article insertion is formed, and this resin case 12 is formed every three sides where the external connection terminals 13a, 13b, 13c, 13d, 13e, and 13f counter. The other end of each of that external connection terminal 13 is the interior of the resin case 12, and has flowed with the connection electrode. The external terminals 13a and 13d flowed with connection electrode 14a, and have connected [ external terminal 13b / connection electrode 14b and external terminal 13c ] connection electrode 14e and 13f of external terminals with 14f of connection electrodes for connection electrode 14c and external terminal 13e, respectively. The central conductor assembly 16, the capacitors 17, 18, and 19 for adjustment, and a resistance element 20 are arranged in the crevice for components insertion of the resin case 12. Moreover, the capacitors 21 and 22 for serial LC circuits are arranged.

[0025] Three central conductors 24, 25, and 26 are inserted in so that this central conductor assembly 16 may wrap in a ferrite 23. On both sides of an insulation sheet, it insulates mutually on the whole surface of a ferrite 23 between each central conductor, and this central conductor crosses at the predetermined include angle. This central conductor assembly 16 is arranged at the hole 15 of the center of the resin case 12, this hole 15 is penetrated, the lower part of a ferrite 23 joins to the bottom case 11, and each central conductor has structure grounded by the end.

[0026] Resin case 12 part of this example is further explained to a detail. The capacitors 17, 18, and 19 for adjustment are arranged on the connection electrodes 14a and 14b of the resin case 12, and 14e. The capacitors 17, 18, and 19 for this adjustment are plate capacitors, and one electrode flows through them with that connection electrode. Moreover, a resistance element 20 is arranged on connection electrode 14a of the resin case 12. One electrode is extended to the lower part and this resistance element 20 flows with a connection electrode. And each central conductors 24, 25, and 26 are arranged on each capacitors 17 and 18 for adjustment, and 19, and the electrode and each central conductor of



another side of each capacitors 17, 18, and 19 for adjustment flow. Moreover, the electrode of another side of a resistance element 20 flows through a central conductor 24.

[0027] Moreover, the capacitors 21 and 22 for serial LC circuits are arranged on connection electrode 14c of the resin case 12, and 14f. These capacitors 21 and 22 for serial LC circuits are also plate capacitors, and one electrode flows through them with those connection electrodes 14c and 14f. And the inductors 27 and 28 for serial LC circuits are arranged and connected between the upper electrode of the capacitors 21 and 22 for the serial LC circuits, and central conductors 25 and 26. This situation is shown in drawing 4.

[0028] And the permanent magnet 30 was positioned by the resin mold 29, the upper case 31 was put, and the concentrated-constant mold isolator was constituted. In addition, this resin mold 29 also has the heights which the crevice 32 which contains inductors 27 and 28 is formed, and support a central conductor and the capacitor for adjustment, and has the work which controls these location gaps etc. To the conventional structure, it is the structure which connected inductors 27 and 28 and capacitors 21 and 22 to the input side and the output side at the serial, and the former and the same size were able to constitute the concentrated-constant mold isolator from this example.

[0029] In this example, using the garnet of 3.9mmphi, and the permanent magnet of 5.5mmphi, it was 7mm angle, small [ with a height of 2mm ], and a thin concentrated-constant mold isolator, and the isolator for 889-960MHz ( $f_0$ :924.5MHz) bands was constituted, and the property shown in Table 1 was acquired.

[0030]

[Table 1]

	挿入損失 (dB)	2倍波減衰量 (dB)	3倍波減衰量 (dB)	VSWR
実施例	0.7	38	41	1.3
比較例	0.6	23	23	1.5

[0031] As shown in Table 1, in the example of this invention, although an insertion loss increases a little, it can broadband-ize VSWR, and can be raising sharply the amount of 2 double decay of waves of center frequency ( $f_0$ ), and the amount of 3 time decay of waves. The example of a comparison of this table 1 is the case of the structure where the inductors 27 and 28 of an example and capacitors 21 and 22 are not connected.

[0032] Although the chip inductor was used as an inductor for serial LC circuits in the above-mentioned example, you may be the inductor of other configurations. Moreover, the laminating LC chip which carried out the laminating may be used for one as the inductor and capacitor for serial LC circuits.

[0033] In the above-mentioned example, although the serial LC circuit of an inductor and a capacitor was connected to the input edge and the outgoing end, you may connect with either an input one end side or an outgoing end side. Moreover, although the isolator explained in the above-mentioned example, it is the same even if it is a circulator.

[0034] While measuring broadband-ization by connecting an inductor and a capacitor only to an input side, an output side or an input side, and an output side at a serial according to the example of this invention, 2 double wave and the higher harmonic of a 3 time wave can be controlled, components called the low pass filter conventionally added as another components can be eliminated, and advanced features of a concentrated-constant mold non-reciprocal circuit component and the miniaturization of a microwave device can be attained.

[0035]

[Effect of the Invention] In a concentrated-constant mold non-reciprocal circuit component, by connecting the serial LC circuit of an inductor and a capacitor to the central conductor of an input side and/or an output side, while measuring broadband-ization, according to this invention, the concentrated-constant mold non-reciprocal circuit component which can obtain high attenuation of a higher harmonic can be obtained. Moreover, using a resin case, it is surface mounting, and it is the concentrated-constant mold non-reciprocal circuit component moreover collected into the compact, and high attenuation of a higher harmonic can be obtained. Moreover, one component can attain what has the required components of the conventional plurality. Moreover, it is the former and the same size also as a concentrated-constant mold non-reciprocal circuit component, and moreover, it is attained with easy structure and is very useful to the miniaturization of a device, and low-cost-izing.

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to the concentrated-constant mold non-reciprocal circuit component which can control the higher harmonic of a wave 2 double wave and 3 times by measuring broadband-ization especially about concentrated-constant mold non-reciprocal circuit components used for microwave communication equipment, such as a cellular phone, etc., such as a circulator and an isolator.

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## PRIOR ART

[Description of the Prior Art] Conventionally, concentrated-constant mold non-reciprocal circuit components, such as a circulator and an isolator, have the property which transmits power only in the specific direction and is not transmitted to hard flow, and are used for microwave communication equipment. It is in an insulating condition mutually, and this concentrated-constant mold non-reciprocal circuit component arranges three central conductors piled up at intervals of 120 degrees on the magnetic substance, has the permanent magnet which impresses a direct-current field to that magnetic substance, it contains these in the case used as magnetic York, and is constituted.

[0003] The decomposition perspective view of the concentrated-constant mold non-reciprocal circuit component of a conventional example is shown in drawing 5. This conventional example is a concentrated-constant mold isolator, it piled up three central conductors 8 of each other in the state of the insulation on the magnetic substance which consists of a disc-like ferrite 7 (product made from a garnet) between the upper case 1 and the bottom case 2, has arranged this central conductor assembly to the bore of a ceramic substrate 3, and arranges it on the bottom case 2 with the ceramic substrate 3. The end of each central conductor 8 is grounded by the bottom case at this time. Moreover, the other end of each central conductor 8 is connected to the electrostatic-capacity formation electrode 4 formed on the ceramic substrate 3. Termination of the electrode 4a for one electrostatic-capacity formation is connected and carried out to the earth electrode 6 through the dummy resistor 5. Moreover, the permanent magnet 9 which impresses a direct-current field to the magnetic substance is arranged at the upper case 1, this upper case 1 and the bottom case 2 are joined, and the concentrated-constant mold isolator is constituted.

[0004] Besides, a case 1 and the bottom case 2 are the magnetic substance, work as magnetic York and constitute the magnetic circuit which impresses the magnetism of a permanent magnet to a ferrite 7. Moreover, among three central conductors, the end of two central conductors 8 is extended and is used as a projection and an input/output terminal. Moreover, this central conductor assembly consists of three central conductors which project from a circular plate, arranges a ferrite on that plate, and it is turned up, and it piles up and it is constituted so that that ferrite may be wrapped in. In addition, it insulates between this central conductor.

[0005] This concentrated-constant mold non-reciprocal circuit component is used for an input terminal or output terminal side for the low pass filter which controls harmonic content in many cases, connecting, when used in microwave communication equipment, such as a cellular phone. As this low pass filter, it was constituted in many cases on the substrate with which a concentrated-constant mold non-reciprocal circuit component is mounted.

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EFFECT OF THE INVENTION

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[Effect of the Invention] In a concentrated-constant mold non-reciprocal circuit component, by connecting the serial LC circuit of an inductor and a capacitor to the central conductor of an input side and/or an output side, while measuring broadband-ization, according to this invention, the concentrated-constant mold non-reciprocal circuit component which can obtain high attenuation of a higher harmonic can be obtained. Moreover, using a resin case, it is surface mounting, and it is the concentrated-constant mold non-reciprocal circuit component moreover collected into the compact, and high attenuation of a higher harmonic can be obtained. Moreover, one component can attain what has the required components of the conventional plurality. Moreover, it is the former and the same size also as a concentrated-constant mold non-reciprocal circuit component, and moreover, it is attained with easy structure and is very useful to the miniaturization of a device, and low-cost-izing.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] For example, a cellular phone spreads with vigor frightful in recent years, and the miniaturization is also progressing quickly. And the miniaturization is demanded also for the concentrated-constant mold non-reciprocal circuit component used for the cellular phone. Moreover, not only a miniaturization but to be low cost is demanded. Moreover, since it corresponds to the escape of the frequency band by the increment in the number of subscribers, the engine performance which covers a broadband is demanded.

[0007] The equal circuit which shows the conventional non-reciprocal circuit component to drawing 6 as circuitry for broadband-izing is known. In this conventional example, series resonant circuits 51, 52, and 53 are connected to all I/O edges. Thereby, a double hump response is acquired and can broadband-ize. In addition, in this conventional example, termination of the other end of a resonance circuit 53 is carried out by Terminator R.

[0008] Thus, with the conventional concentrated-constant mold non-reciprocal circuit component, in order to broadband-ize, the resonance circuit was connected to each I/O edge, i.e., all central conductors, and there were many component parts and they were disadvantageous structure to a miniaturization and low-cost-izing. Moreover, also in order to control harmonic content, it was the structure of connecting a low pass filter on the mounting substrate of a non-reciprocal circuit component, and was disadvantageous structure to a miniaturization and low-cost-izing.

[0009] This invention adds the function to broadband-ize for a concentrated-constant mold non-reciprocal circuit component, and to attenuate harmonic content. The low pass filter connected in the exterior of a concentrated-constant mold non-reciprocal circuit component is lost, and it aims at offering the concentrated-constant mold non-reciprocal circuit component which can attain the whole miniaturization. With moreover very simple structure It aims at offering the concentrated-constant mold non-reciprocal circuit component which can obtain high attenuation of a higher harmonic at the same time it achieves broadband-ization.

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MEANS

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[Means for Solving the Problem] The central conductor assembly constituted by this invention arranging two or more central conductors in the electric insulation condition in the shape of a crossover to a ferrite, The resin case where it has the crevice and external terminal which position the capacitative element for adjustment connected to said each central conductor, said central conductor assembly, said capacitative element, etc., It is the concentrated-constant mold non-reciprocal circuit component which has the permanent magnet which carries out the seal of approval of the direct-current field to said ferrite, and comes to arrange these in the metal casing which serves as magnetic York. Among said central conductors The central conductor for an input and/or an output, The serial LC circuit is connected between this input and/or the output terminal, and said resin case has the crevice which positions the capacitative element said object for adjustment, and for serial LC circuits. At the pars basilaris ossis occipitalis of this crevice It has the connection electrode which flowed for the external terminal, one electrode of the capacitative element said object for adjustment and for serial LC circuits is connected on this connection electrode, and each capacitative element is arranged. The end of said central conductor It is the concentrated-constant mold non-reciprocal circuit component by which connects with the electrode of another side of said capacitative element for adjustment, and L elements are connected between said object for an input and/or the central conductor for an output, and the electrode of another side of the capacitative element for said serial LC circuits.

[0011] Moreover, this invention is a concentrated-constant mold non-reciprocal circuit component by which the resin mold which has the crevice which contains said L elements, has the heights which support said capacitative element, and has the through hole which positions a magnet is arranged on said resin case.

[0012] Moreover, the crevice of said resin case where, as for this invention, said central conductor assembly is arranged is a concentrated-constant mold non-reciprocal circuit component used as a through hole.

[0013] Moreover, the other end of at least one central conductor is a concentrated-constant mold non-reciprocal circuit component by which termination is connected and carried out to resistance among the central conductors to which, as for this invention, said serial LC circuit is not connected.

[0014] Moreover, this invention is a concentrated-constant mold non-reciprocal circuit component said whose L elements are chip inductors.

[0015]

[Embodiment of the Invention] This invention considered setting the low pass filter connected not only to a concentrated-constant mold non-reciprocal circuit component but to the input side or output side, and miniaturizing. Moreover, it examined whether-izing could be carried out [ broadband ] in a simple circuit. And it is contained by magnetic York and only an input side makes [ an output side ] it possible to obtain high attenuation of broadband-izing and a higher harmonic by connecting LC circuit to the edge of the central conductor of only an input side and an output side at a serial into the concentrated-constant mold non-reciprocal circuit component formed into the one package.

[0016] Like before, unlike the structure of connecting a resonance circuit to all central conductors, it is only connecting a serial LC circuit alternatively, and the serial LC circuit connected to a central conductor can reduce components mark in this invention. And in this invention, high attenuation of a higher harmonic can be obtained and connection of a low pass filter like before is made unnecessary.

[0017] That is, in this invention, a serial LC circuit measures broadband-ization and has the operation which moreover obtains high attenuation of a higher harmonic.

[0018] Although a coil can be formed and used for the inductor of the serial LC circuit of this invention by the pattern

of copper foil for example, on a flexible substrate or a printed circuit board, it is desirable that it is a chip inductor.

[0019] Although a chip capacitor is sufficient as the capacitor of the serial LC circuit of this invention, it is desirable to use the veneer capacitor which prepared the electrode, for example in both sides of the sheet metal of a dielectric.

[0020] Although it is desirable to connect with both the input side of an isolator and an output side as for this serial LC circuit, it may be connected only to an input side or an output side.

[0021] This invention prepares the crevice and external terminal which position the capacitive element for the object for adjustment, and serial LC circuits in a resin case, prepares the connection electrode which flowed for the external terminal at the pars basilaris ossis occipitalis of this crevice, connects one electrode of said capacitive element on this connection electrode, and each capacitive element is arranged. And L for serial LC circuits are connected between the central conductor which the end of a central conductor is connected to the electrode of another side of the capacitive element for adjustment arranged on said connection electrode, and is connected to the terminal for an input, and/or the terminal for an output, and the electrode of another side of the capacitive element for serial LC circuits arranged on said connection electrode. Thereby, each component can be arranged efficiently and the concentrated-constant mold non-reciprocal circuit component is constituted in small and a thin shape.

[0022] Moreover, the resin case of this invention can measure thin shape-ization by having the crevice which positions a central conductor assembly, and improving connectability with a capacitive element etc., and making the crevice into the letter of penetration.

[0023] Moreover, in order to raise location precision arranged on a resin case, such as a capacitive element and L etc. elements, in this invention, and to prevent a location gap etc. and to support, the resin mold which has the crevice which contains L elements, has the heights which support said capacitive element, and has the through hole which positions a magnet is arranged on a resin case.

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## EXAMPLE

[Example] The decomposition perspective view of the 1st example concerning this invention is shown in drawing 1 . Moreover, the representative circuit schematic of this example is shown in drawing 2 . This example is a concentrated-constant mold isolator. Moreover, the top view of the resin case of this example is shown in drawing 3 . The slash section shows the electrode (connection electrode) by drawing 1 and 3. As for this example, the resin case 12 is arranged on the bottom case 11. The crevice for each part article insertion is formed, and this resin case 12 is formed every three sides where the external connection terminals 13a, 13b, 13c, 13d, 13e, and 13f counter. The other end of each of that external connection terminal 13 is the interior of the resin case 12, and has flowed with the connection electrode. The external terminals 13a and 13d flowed with connection electrode 14a, and have connected [ external terminal 13b / connection electrode 14b and external terminal 13c ] connection electrode 14e and 13f of external terminals with 14f of connection electrodes for connection electrode 14c and external terminal 13e, respectively. The central conductor assembly 16, the capacitors 17, 18, and 19 for adjustment, and a resistance element 20 are arranged in the crevice for components insertion of the resin case 12. Moreover, the capacitors 21 and 22 for serial LC circuits are arranged.

[0025] Three central conductors 24, 25, and 26 are inserted in so that this central conductor assembly 16 may wrap in a ferrite 23. On both sides of an insulation sheet, it insulates mutually on the whole surface of a ferrite 23 between each central conductor, and this central conductor crosses at the predetermined include angle. This central conductor assembly 16 is arranged at the hole 15 of the center of the resin case 12, this hole 15 is penetrated, the lower part of a ferrite 23 joins to the bottom case 11, and each central conductor has structure grounded by the end.

[0026] Resin case 12 part of this example is further explained to a detail. The capacitors 17, 18, and 19 for adjustment are arranged on the connection electrodes 14a and 14b of the resin case 12, and 14e. The capacitors 17, 18, and 19 for this adjustment are plate capacitors, and one electrode flows through them with that connection electrode. Moreover, a resistance element 20 is arranged on connection electrode 14a of the resin case 12. One electrode is extended to the lower part and this resistance element 20 flows with a connection electrode. And each central conductors 24, 25, and 26 are arranged on each capacitors 17 and 18 for adjustment, and 19, and the electrode and each central conductor of another side of each capacitors 17, 18, and 19 for adjustment flow. Moreover, the electrode of another side of a resistance element 20 flows through a central conductor 24.

[0027] Moreover, the capacitors 21 and 22 for serial LC circuits are arranged on connection electrode 14c of the resin case 12, and 14f. These capacitors 21 and 22 for serial LC circuits are also plate capacitors, and one electrode flows through them with those connection electrodes 14c and 14f. And the inductors 27 and 28 for serial LC circuits are arranged and connected between the upper electrode of the capacitors 21 and 22 for the serial LC circuits, and central conductors 25 and 26. This situation is shown in drawing 4 .

[0028] And the permanent magnet 30 was positioned by the resin mold 29, the upper case 31 was put, and the concentrated-constant mold isolator was constituted. In addition, this resin mold 29 also has the heights which the crevice 32 which contains inductors 27 and 28 is formed, and support a central conductor and the capacitor for adjustment, and has the work which controls these location gaps etc. To the conventional structure, it is the structure which connected inductors 27 and 28 and capacitors 21 and 22 to the input side and the output side at the serial, and the former and the same size were able to constitute the concentrated-constant mold isolator from this example.

[0029] In this example, using the garnet of 3.9mmphi, and the permanent magnet of 5.5mmphi, it was 7mm angle, small [ with a height of 2mm ], and a thin concentrated-constant mold isolator, and the isolator for 889-960MHz



(f0:924.5MHz) bands was constituted, and the property shown in Table 1 was acquired.

[0030]

[Table 1]

	挿入損失 (dB)	2倍波減衰量 (dB)	3倍波減衰量 (dB)	VSWR
実施例	0.7	3.8	4.1	1.3
比較例	0.6	2.3	2.3	1.5

[0031] As shown in Table 1, in the example of this invention, although an insertion loss increases a little, it can broadband-ize VSWR, and can be raising sharply the amount of 2 double decay of waves of center frequency (f0), and the amount of 3 time decay of waves. The example of a comparison of this table 1 is the case of the structure where the inductors 27 and 28 of an example and capacitors 21 and 22 are not connected.

[0032] Although the chip inductor was used as an inductor for serial LC circuits in the above-mentioned example, you may be the inductor of other configurations. Moreover, the laminating LC chip which carried out the laminating may be used for one as the inductor and capacitor for serial LC circuits.

[0033] In the above-mentioned example, although the serial LC circuit of an inductor and a capacitor was connected to the input edge and the outgoing end, you may connect with either an input one end side or an outgoing end side.

Moreover, although the isolator explained in the above-mentioned example, it is the same even if it is a circulator.

[0034] While measuring broadband-ization by connecting an inductor and a capacitor only to an input side, an output side or an input side, and an output side at a serial according to the example of this invention, 2 double wave and the higher harmonic of a 3 time wave can be controlled, components called the low pass filter conventionally added as another components can be eliminated, and advanced features of a concentrated-constant mold non-reciprocal circuit component and the miniaturization of a microwave device can be attained.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the decomposition perspective view of the 1st example concerning this invention.

[Drawing 2] It is the representative circuit schematic of the 1st example concerning this invention.

[Drawing 3] It is the top view of the resin case of the 1st example concerning this invention.

[Drawing 4] It is the central conductor of the 1st example and the explanatory view of the connection of a serial LC circuit concerning this invention.

[Drawing 5] It is the decomposition perspective view of the conventional example.

[Drawing 6] It is the representative circuit schematic of a conventional example.

[Description of Notations]

11 Bottom Case

12 Resin Case

13a, 13b, 13c, 13d, 13e, 13f External terminal

14a, 14b, 14c, 14e, 14f Connection electrode

15 Through Hole

16 Central Conductor Assembly

17, 18, 19 Capacitor for adjustment

20 Resistance Element

21 22 Capacitor for serial LC circuits

23 Ferrite

24, 25, 26 Central conductor

27 28 Inductor for serial LC circuits

29 Resin Mold

30 Magnet

31 Upper Case

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[Translation done.]